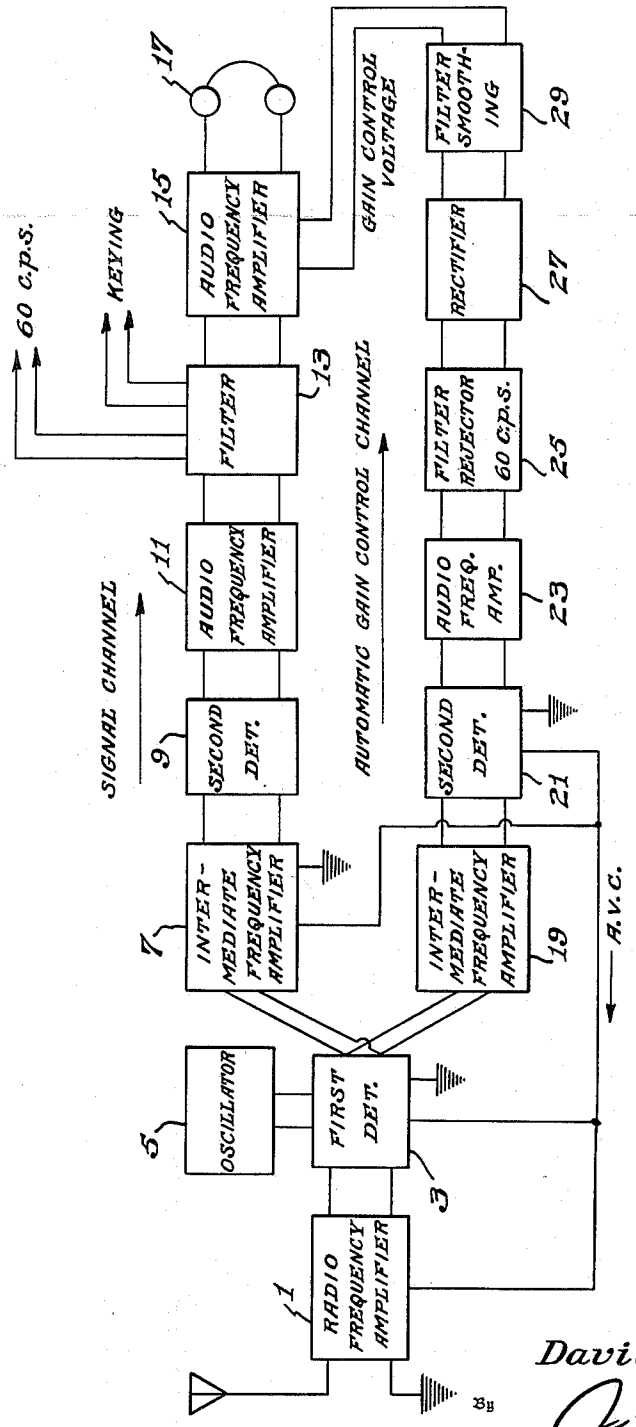
Feb. 3, 1942. D. G. C. LUCK 2,271,522

RECEIVER FOR OMNIDIRECTIONAL BEACONS

Filed Jan. 31, 1940



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Patented Feb. 3, 1942

2,271,522

UNITED STATES PATENT OFFICE

2,271,522

RECEIVER FOR OMNIDIRECTIONAL BEACONS

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Application January 31, 1940, Serial No. 316,648

5 Claims. (Cl. 250—11)

This invention relates to apparatus for and the method of receiving speech and directional signal information from an omnidirectional radio beacon transmitter and more especially to an omnidirectional beacon in which the reference signal is introduced by keying.

Omnidirectional radio signals are established by producing a reference field and a rotating field. The relative phase of currents generated by the rotating field varies with respect to currents generated by the reference field as a function of the angle between a reference line and a radial line passing through a receiver located within the fields. The rotating field may be created by applying currents of sideband frequency in quadrature phase to four antennas which are symmetrically located about a main antenna. The carrier currents are applied to the main antenna. The carrier currents are keyed off at the moment the maximum of the rotating field coincides with the reference line, which may, by way of example, be due north. Speech frequency currents may be applied to the carrier. The details of such an omnidirectional beacon are disclosed in applicant's U. S. Patent No. 2,208,376, which issued July 16, 1940, application Serial No. 156,055, filed July 28, 1937, for improvement in Rotating radio beacon.

It has been found that the simultaneous transmission of directional signals and speech does not markedly affect the bearing indication, nor does the directional signal seriously impair the intelligibility of speech. However, it has been found that an operator's hearing may be impaired temporarily if he listens to the keying signals for long intervals. This temporary impairment makes it temporarily difficult to understand the speech signals.

While in the case of a conventional radio range the speech and range modulation signals may be separately filtered, in the case of a keyed or pulsed reference signal, the harmonic components are so evenly distributed throughout the audio range that filtering becomes extremely difficult and impractical. Since the keying signal contains little energy compared with the average value of normal speech modulation, it is an object of this invention to provide means whereby the signal channel will be blocked for the keying signals and unblocked for the speech signals. Another object is to provide means whereby the speech signals from an omnidirectional radio beacon transmitter are filtered from the directional modulation signals and are applied to control the response of an audio amplifier in the signal channel of the beacon receiver. Another object of the invention is to provide an improved method of receiving simultaneously speech and directional signals from an omnidirectional radio beacon.

The invention will be described by referring to the accompanying drawing which is a schematic circuit diagram of one embodiment of the invention.

Referring to the drawing, a radio frequency amplifier 1 is connected to a first detector 3, which is coupled to a local oscillator 5. The output of the detector 3 is applied to two channels; the first being a signal channel, the second being an automatic gain control channel.

The signal channel includes an intermediate frequency amplifier 7, a second detector 9, a first audio frequency amplifier 11, a filter 13, a second audio frequency amplifier 15, and telephone receivers 17 or other audio signal indicator. The filter 13 includes elements for separating the directional modulation signal currents and the reference keying currents which are applied to a visual indicator as described in the above mentioned application.

The automatic gain control channel includes an intermediate frequency amplifier 19, a second detector 21, an audio frequency amplifier 23, a filter 25 for rejecting the directional signal modulation currents, a rectifier 27, and a filter 29 for smoothing the rectified currents.

The several component parts of the two channels are connected serially in accordance with the conventional practice in superheterodyne receivers. The output from the smoothing filter 29 is applied to the last amplifier 15 in the signal channel. The output from the second detector 21 in the automatic gain control channel is applied to the radio frequency amplifier 1, first detector 3, and the intermediate frequency amplifier 7 of the signal channel to control automatically their sensitivity in the manner of a conventional automatic volume control, hereinafter called A. V. C.

The operation of the receiver is as follows: The modulation (due to the rotating field), keying, speech, and carrier signals are received, amplified and converted into intermediate frequency currents. The intermediate frequency currents are amplified and detected in both the signal channel 7, 9 and the automatic gain control channel 19, 21. The detected currents in the former include the modulation, keying and speech signals which are amplified by the audio amplifier 11. The modulation frequency (60 cycles per

second, by way of example) currents are filtered, by means of a filter 13, and are applied to a visual indicator. The keying currents are likewise derived from the filter 13 and are applied to the indicator. The filter 13 does not remove the keying frequency from the speech frequency currents which may have the objectionable features above described. The speech frequency currents including the keying signal are applied to the amplifier 15, which is blocked when no speech is being transmitted, as hereinafter described.

The detected currents in the automatic gain control channel may be applied as A. V. C. to the radio frequency amplifier 1, first detector 3, and intermediate frequency amplifier 7. The detected currents are also amplified by the amplifier 23. The currents from the amplifier are filtered to remove the modulation frequency corresponding to the frequency of the rotating field of the beacon. This filtering is not difficult because the low frequency modulation is not required to transmit intelligible speech. The filtered currents are rectified by rectifier 27. It has been found that the keying signals, while of high amplitude, are of low energy content. In relation to the keying signals, the speech signals represent high energy content. Therefore, the rectified and filtered currents may be applied to the audio amplifier 15 in the signal channel to unblock the amplifier for speech signals.

Thus arranged, the directional signals (modulation and keying) pass through the signal channel to a visual indicator. The telephones 17, being connected to the normally blocked amplifier 15, are not responsive to the keying signals nor the modulation signals from the rotating field. Speech and keying signals pass through the amplifier to the telephones when the same signals, after passing through the automatic gain channel, unblock the amplifier.

While the invention has been described with reference to a superheterodyne receiver, it should be understood that the receiver may be of the tunable radio frequency amplifier type. Furthermore, while the keying signal is described as produced by interrupting the fields, it may be produced by applying a pulse signal to modulate the carrier upwardly. Likewise, the frequency of rotation of the beacon field may be chosen from a band of the lower audio frequencies. Finally, it is not essential that the channels be separated at the first detector; the separation may be made after the second detectors 9, 21 audio amplifiers 11, 23.

I claim as my invention:

1. A receiver for an omnidirectional radio beacon of the type employing a rotating field including directional modulation signals, an omnidirectional carrier, keying reference signals and speech signals including a radio receiver for deriving from the beacon signals currents corresponding to the beacon directional modulation signals, to the keying signals, and to speech frequency signals, means, connected to said radio receiver and normally blocked to said keying signals, responsive to said speech frequency signals upon being unblocked, and means for deriving and for applying to said speech responsive means controlling currents from said beacon signals to unblock said speech responsive means to said speech frequency signals.

2. A receiver for an omnidirectional radio beacon of the type including keying reference signals, rotating field signals, and speech frequency signals, including in combination a radio receiver for deriving from said beacon signals currents corresponding to said keying signal, to rotating field, and to speech frequencies, means responsive to said speech frequency currents connected to said radio receiver and blocked normally to said keying signal currents, a filter connected to said radio receiver for rejecting said rotating field signal currents and for passing said keying and speech currents, a rectifier connected to said filter for deriving from the currents passed thereby a controlling voltage for unblocking said speech responsive means in response to the reception of said speech frequency signals, and means for applying said controlling voltages to said speech responsive means.

3. A radio receiver responsive to an omnidirectional radia beacon transmitting directional and speech signals including a first channel responsive to currents corresponding to said directional signals and to currents corresponding to said speech signals, said first channel including an amplifier normally blocked to said directional signals and upon unblocking responsive to said speech signals, and a second channel including a filter for rejecting currents in the lower audio frequency band and for passing speech frequency currents, a rectifier for rectifying said speech frequency currents, and means for applying the rectified currents to unblock said amplifier.

4. A radio receiver of the type described in claim 3 including a filter connected in said first channel before said normally blocked amplifier to reject currents of the lower audio frequency band and passing currents of speech frequencies.

5. A radio receiver responsive to an omnidirectional radio beacon of the type employing a field rotating at modulation frequency, an omnidirectional carrier, keyed reference signals and speech signals including means for deriving currents corresponding to said modulation frequency, said keyed signals and said speech signals, a filter connected to said current deriving means for separating said currents into directional information bearing currents and speech currents, an amplifier connected to said filter responsive to speech frequency currents and normally blocked for said keyed signals, means for deriving controlling voltages from said speech signal currents, and means for applying said controlling currents to said amplifier to unblock said amplifier in response to the reception of said speech currents.

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